No 106 BULLETIN 1930-31
OF THE
AGRICULTURAL EXTENSION SERVICE, THE OHIO STATE UNIVERSITY
H. C RAMSOWER, Director

Pickles and Pickling

By

Lelia C. Ogle

Extension Specialist in Nutrition
The Ohio State University

THE OHIO STATE UNIVERSITY, COLUMBUS, OHIO, AND THE UNITED STATES DEPARTMENT
OF AGRICULTURE COOPERATING
AGRICULTURAL EXTENSION SERVICE—H. C. RAMSOWER, Director
FREE—Cooperative Agricultural Extension Work—Acts of May 8 and June 30, 1914

PICKLES AND PICKLING

By

LELIA C. OGLE
Specialist in Nutrition
The Ohio State University

Fruits and vegetables preserved with salt, vinegar, or both, and with or without the addition of sugar and spices, constitute what is commonly called pickles.

The discussion in this bulletin will be confined to the principles of pickling as they apply especially to cucumber pickles, in an effort to answer some of the many questions on the process and its difficulties.

Cucumbers may be preserved by means of (1) fermentation as the result of the action of the bacteria on the sugar of the vegetables; (2) the addition of acid, usually vinegar; or (3) addition of a very strong brine. Any of these methods prevent bacterial growth if all other conditions are right.

The secret of making pickles by the fermentation process lies in bringing about acid fermentation quickly, and after this is done, in preserving the acidity of the brine by covering tightly or sealing to exclude air. It is the acid formed by the action of bacteria on the sugar of the vegetables that cures and keeps the vegetables, if all air is excluded and scum yeast has not been allowed to develop. Bubbles indicate that fermentation is taking place, and acid turns the grass-green color of the vegetables to an olive green, which is considered the correct color for cucumber pickles. When frothing ceases, acid has been formed sufficient to kill most of the bacteria in the liquid.

INGREDIENTS

Cucumbers or Other Vegetables.—For pickling, the product should be fresh, crisp, and whole. Green or slightly underripe fruits and vegetables make firmer, crisper pickles than fully matured. Cucumbers should be cut from the vines leaving one-eighth to one-fourth inch of the stem, and should not be bruised. Do not allow cucumbers to stand more than twenty-four hours after gathering.

Because of their shape, firmness, and keeping qualities, the following varieties are recommended in Ohio: Snow's Pickling Cucumbers, Chicago Pickling, and Boston Pickling Cucumbers of all varieties, sizes, and shapes make good pickles if they are free from disease and cut as they approach the ripening stage.

Grade the cucumbers according to size.

Vinegar.—Use cider vinegar of good sharp quality, testing 4 to 6 per cent acetic acid; it should be filtered or strained to remove all sediment. An index of the strength of vinegar can be had from its odor and taste.

Spices.—These should be used in moderation. Fresh spices should be purchased each year. In most cases a better blending of flavors is obtained from mixing spices than from the use of ready mixed spices.

Spices are usually tied in a cheesecloth and cooked with the vinegar only long enough to give it a spicy flavor. The bag is then removed, for spices kept too long in the vinegar cause an unpleasant strong flavor and a dark color to develop.

Salt.—Common fine salt is to be preferred to fine table salt. Salt which has a substance added to prevent caking is not recommended.

Water.—Soft water is recommended. If water contains much lime, add a small amount of vinegar to the water which is to be used for brine. Too much mineral salts in the water may prevent proper acid formation in pickles made by the fermentation process. Too much iron may cause a blackening of the pickles.

Brine.—The concentration of a brine can be accurately measured by an instrument called a salimeter. This is a hydrometer or spindle which shows density or strength of the brine by floating in the liquid. Quite accurate results, however, can be obtained by weighing the salt and measuring the water (see table of brine solutions).

TABLE OF BRINES *

Approximate percentage of brine solution	Weight of salt	Quantity of water	Degrees in a salimeter
1%	2 ounces	6 quarts	4°
2%	4 ounces	6 quarts	8°
3%	6 ounces	6 quarts	12°
4%	8 ounces	6 quarts	16°
5%	10 ounces	6 quarts	20°
6%	12¼ ounces	6 quarts	24°
7%	14½ ounces	6 quarts	28°
8%	16½ ounces	6 quarts	60°
9%	1 lb., 3 oz.	6 quarts	32°
10%	1 lb., 6 oz.	6 quarts	36°
15%	2 lb., 4 oz.	6 quarts	40°

* United States Department of Agriculture. Farmers' Bulletin 1438.

Cucumbers are usually treated in a 10 to 15 per cent brine (40° to 60° salimeter). A brine that will barely float a fresh egg is approximately a 10 per cent brine. Salt draws the water from the vegetable tissue and the water drawn out tends to weaken the brine solution. As the brine becomes weaker, more salt should be added. Since too strong a brine tends to toughen cucumbers, it is recommended that the brine concentration should not exceed 12 per cent (45° salimeter). In checking up on changes in concentration in the brine, the salimeter is especially helpful, as it measures accurately.

The tables of brines on page 3 may be of assistance in making brines of the desired concentration.

EQUIPMENT

Stone Jars.—A 4-gallon stone jar will take about 12 pounds (¼ bushel) of cucumbers and is a convenient size to handle.

A Cover.—A disk of tasteless wood, approximately an inch thick, or a porcelain or china plate which is an inch smaller than the jar, may be used to hold the pickles below the surface of the liquid.

Cheesecloth, or Muslin.—A cloth is used to cover the pickles after they are packed.

Utensils for Cooking.—Only porcelain-lined or enamel kettles should be used in cooking pickles. Granite or wooden spoons should be used for stirring.

Jars for Storage.—Finished pickles should be stored in sterilized jars or crocks. Those to be sealed are best put into the glass jars with glass tops, as metal tops corrode on standing.

Pickles may also be stored in stone jars or in glass cans without sealing. They should keep indefinitely in a cool place if kept weighted below the surface of the liquid. A layer of grape or horseradish leaves is often placed on top of the pickles before the weight is put in position.

Glass jars with metal covers are not recommended, as the acid attacks the metal, causing it to corrode.

PICKLE TROUBLES

Shrivelling.—If the vinegar is too hot or too strong when poured over fruits or vegetables, it may cause them to shrivel. Too strong a brine or too much sugar will also cause shrivelling.

Sweet pickles very often shrivel due to the combination of over-cooking, too much sugar, and too strong a vinegar.

Softening.—This is due to bacterial action.

If vinegar or brine is too weak, pickles may soften from fermentation. Pickles kept in too warm storage often become soft.

Vinegar boiled too long loses strength and may cause softening.

Pickles cooked too long soften from overcooking.

Pickles exposed above the brine or vinegar become soft.

Once pickles have become soft, they cannot be restored in firmness and crispness.

Bitter Flavor.—A bitter flavor may be caused by boiling the spices in the vinegar too long or by using too much spice.

Crisping.—Soaking in brine (1 pound salt to 1 gallon water) for 24 hours makes cucumbers crisp and improves the flavor.

Spoilage.—A soft or slippery condition is the most common form of spoilage. It is caused by bacterial action. It will always occur if pickles are exposed above the brine and if the brine solution is too weak.

This spoilage does not penetrate rapidly to the lower layers, so untouched parts of the jar may often be saved by removing the spoiled part, adding brine, and covering the whole with hot paraffin.

Hollow Pickles.—This may happen during curing or it may be due to faulty development of the cucumbers. It may be caused by allowing the cucumbers to stand too long a time before taking care of them. They should not stand more than 24 hours.

Scum.—Top layers of vegetables fermented in brine will spoil unless the scum is frequently removed. If allowed to remain, the vegetables underneath are attacked and broken down. Top layers are the first attacked. The lower layers of the pickles may be saved by removing the top layers, adding a little fresh brine, and pouring hot paraffin over the surface.

Coloring and Hardening Agents.—To make pickles "green" they are often heated in a copper vessel. This is not a recommended practice, as copper acetate is thereby formed and the pickles take up appreciable quantities of it. *Copper acetate is a poisonous substance.*

Alum is often used presumably to make pickles firm and crisp. The use of alum, however, is of doubtful value. The salt and acids in the brine will give the desired firmness if correct methods are followed.

SALTING OR BRINING

This is a good way to take care of surplus cucumbers that cannot be used or sold. This method has been used since early times during the busy canning season when vinegar, sugar and spices are likely to be expensive. By this process, string beans, green tomatoes, beets, mango melons, burr gherkins, and cucumbers may be preserved in a 10 per cent brine (40° salimeter scale) for several months. Salting may be done with or without fermentation.

When cucumbers are to be put into brine, they need not be washed unless dirty, as the bacteria on the outside seem to aid in the process. They are washed, anyway, before eating.

Cucumbers contain about 90 per cent of water. This large water content reduces materially the salt content of any brine into which they are put. This makes necessary the addition of an excess of salt at the beginning of fermentation (1 pound to each 10 pounds cucumbers) as explained under "Fermentation in Brine."

Active fermentation continues from 10 to 30 days, according to the temperature at which conducted; 86 degrees F. is considered a favorable temperature.

During fermentation all sugar in the cucumbers is utilized and at the end the brine reaches its highest acidity. Great care should be taken when adding salt, not to retard the growth of the lactic acid bacteria. Although cucumbers are fairly tolerant of salt there is a limit to their tolerance. Salt is therefore added gradually over a period of weeks, as directed under "Fermentation in Brine."

FERMENTATION IN BRINE

Wash the cucumbers (if dirty) and pack them in a 4-gallon jar, covering with 6 quarts of 10 per cent brine (40° salimeter). This brine solution is made by dissolving 22½ ounces salt in water, then adding sufficient water to make 6 quarts. Next day add salt at the rate of 1 pound for every 10 pounds of cucumbers. This is necessary to maintain the strength of the brine. A cover that will fit inside the jar so that cucumbers can be kept below the surface is needed (see "Equipment," page 4).

At the end of the first week and at the end of each week for five weeks add ¼ pound of salt. In adding salt, always place it on the cover so it will not sink to the bottom before being dissolved. As scum forms, keep it skimmed off.

To determine when the brine reaches the acid stage, test daily with blue litmus paper. When the blue paper turns red, fermentation is gone far enough and all air should be excluded to prevent further fermentation.

During the curing the cucumbers become firm, with a certain translucency and a change in color from pale to dark green. In the perfectly cured pickle, these changes are uniform throughout the pickle. As long as any part of the pickle is whitish or opaque, it is imperfectly cured.

After curing, pickles must be processed in water to remove excess of salt. If to be eaten as salt pickles, only partial processing is necessary. Those to be made into sweet, sour, or mixed pickles should have most of the salt removed. Pickles keep better when salt is not entirely removed.

To process, the pickles are placed in a jar, covered with water, and heated to about 120° F. for 10 or 12 hours, stirring frequently. Pour off the water and repeat if pickles are still too salty.

After processing, sort according to size, using the imperfectly formed ones for mixed pickles. Salt pickles may be eaten as such, or made into other types of pickles, such as sweet, sour, or spiced.

The following table shows the approximate number of pickles to the gallon.

VARIETY	SIZE	NO. IN GALLON
Gherkins	1-2 inches long	250-650
Small pickles	2-3 inches long	130-250
Medium pickles	3-4 inches long	40-130
Large pickles	4 inches and longer	12- 40

RECIPES

TABLE OF MEASURES

c.—cup	T.—tablespoon
gal.—gallon	t.—teaspoon
oz.—ounce	qt.—quart
lb.—pound	pt.—pint

SOUR PICKLES

Drain the processed pickles and cover at once with vinegar. as the vinegar will be reduced in strength by the brine in the pickles it will be necessary to renew the vinegar after a few weeks. If this is not done, the pickles may spoil. Stone jars are the best containers for sour pickles. Covered with vinegar of the right strength and kept in a cool place, they should keep indefinitely.

SWEET PICKLES

Cover the cured and processed cucumbers with a sweet spiced vinegar. Depending on the degree of sweetness desired, 4 to 6 pounds of sugar to the gallon of vinegar may be used. Shrivelling is very likely to take place when a large amount of sugar is used. To avoid this, cover the cured and processed pickles with a good cider vinegar for one week. Discard the vinegar and cover with a liquor made by dissolving 4 pounds of sugar in a gallon of vinegar. (More sugar may be used if a sweeter pickle is preferred.) The acidity of the liquor should be kept as high as possible.

If spices are desired, 1 ounce of whole mixed spices to 4 gallons of pickles is enough. Spices are put in a cheesecloth bag and heated with the vinegar until the desired spicy flavor is obtained, then removed.

DILL PICKLES—NO. 1

Place in the bottom of the jar a layer of dill and ½ ounce of mixed spices. Fill the jar within two or three inches of the top with washed cucumbers of uniform size. The large cucumbers may be used. Add another layer of dill and another ½ ounce of spice. Cover with a layer of grape leaves.

Pour over the cucumbers a brine as follows:

1 lb. salt
1 pt. vinegar
2 gallons water

Weight the pickles below the surface of the brine. In a temperature of 86° F. fermentation should be completed in 10 days to two weeks. Keep scum skimmed off as it forms. When fermentation is complete, the pickles should be protected against spoilage by either of two methods:

(1) Cover with a layer of hot paraffin over the surface of the brine to make a complete seal; or

(2) Seal in glass jars as soon as they are sufficiently cured. Add a small quantity of dill and spice. Cover with their own brine or with fresh brine, which has been heated to a boiling point and cooled to 160° F. Fill the jars full, seal tight, and store in a cool place.

The second method has the advantage of furnishing small amounts of pickles as they are needed. Whenever the paraffin seal is broken, the paraffin must be reheated and the jar sealed again.

DILL PICKLES—NO. 2

1 c. salt	Cucumbers
3 c. vinegar	9 c. water

Select cucumbers (dill size) and arrange in jars. Place good sized flowerets of dill in bottom, center, and top of jar. Heat salt, vinegar, and water to boiling point. Cool, fill jars, and seal.

CUCUMBER PICKLES (UNCOOKED)

Wash and dry small cucumbers. Pack closely into clean jars. To each quart add:

1 T. crushed rock salt	1. T. mixed spices
2 T. sugar	Vinegar to fill the jar

Fill the jar with cold vinegar, seal, and store in a cool place.

Three or four slices of white onion may be added to each jar for flavor, if desired.

MUSTARD PICKLES (UNCOOKED)

1 c. salt	1 c. sugar
1 c. mustard	1 gal. vinegar (dilute if too strong)

Mix salt, mustard, sugar, and vinegar together and pour over cucumbers after they have been in salt water (10 per cent brine) overnight. Keep pickles weighted below the surface of the liquid or seal in fruit jars. Keep in cool place.

OLIVE OIL PICKLES

100 pickles, medium size	¼ c. white pepper
1 qt. onions (small)	1 c. salt
¼ c. celery seed	Cider vinegar
½ c. mustard seed (white)	Olive oil

Wash and slice cucumbers and onions and allow to stand in 10 to 15 per cent brine twelve hours. Drain, rinse, and pack in clean airtight jars. For each 2 cups of cider vinegar, add ½ cup oil. Mix vinegar and spices together and boil 5 minutes. Cool and add olive oil, mixing well. Pour over the cucumbers, being careful to have spices evenly mixed. If there is not sufficient vinegar to cover pickles, add cold vinegar.

CUCUMBER KETCHUP

1 qt. ripe large cucumbers	2 c. vinegar
1 c. white onions	1 c. sugar
2 green peppers, medium size	2 T. white mustard seed
	1 t. salt

Pare cucumbers, cut in quarters and remove pulp. Chop with

onion and pepper. Add water to prevent sticking and cook until tender. Add sugar and seasoning to the vinegar and heat. Add to the mixture and cook until clear. Seal in clean hot jars.

PICCALILLI

1 peck green tomatoes
1 head cabbage
3 peppers, red or green
8 large onions
1 c. salt

Chop and mix together tomatoes, cabbage, onions, and peppers. Add salt and let stand overnight. Drain and add the following ingredients:

2 qts. vinegar
2 c. brown sugar
½ lb. mustard seed
2 T. cinnamon
2 T. ground black pepper
1 T. cloves
1 T. allspice
2 T. ginger
¼ t. cayenne pepper

Place the cloves, allspice, and ginger in a bag. Boil the mixture for 30 minutes, stir frequently, and pour into clean, hot jars. Seal immediately.

PEPPER HASH

1¾ lbs. green peppers
1¾ lbs. red peppers
2½ lbs. onions
Vinegar to cover

Put the green peppers, red peppers, and onions through the food chopper, using a medium coarse cutter. Cover with boiling water and allow to stand 3 to 5 minutes. Drain well. Cover with a weak vinegar (½ vinegar, ½ water) and bring to the boiling point. Drain immediately and squeeze to expel all free liquid. Add the following ingredients to the vegetables and stir thoroughly:

1 pt. vinegar
2 c. sugar
2 T. salt

Bring to boiling point and fill hot into jars. Partly seal and process in hot water bath for 5 minutes. Seal immediately.

BEET AND CABBAGE RELISH

One part diced beets
Two parts chopped cabbage

Wash several good sized beets, put into a kettle, and cover with water. Cover kettle and boil for about 20 minutes or until skins slip off easily. Run cold water over beets until they are cool enough to handle. Drain, slip skins off beets and cut into ¼-inch

cubes. Chop cabbage fine and add to beets, in the proportion of one cup of beets to two cups of cabbage. To each 3 cups of beet and cabbage mixture, add the following:

3 c. vinegar
3 oz. salt
3 oz. prepared mustard
1 t. cinnamon
1 t. ground pepper
1 t. ground allspice

Mix thoroughly. Allow mixture to stand overnight, pack in jars, partly seal, and process in hot water bath (pint jars for 5 minutes and quart jars for 8 minutes). Seal immediately.

SPICED GREEN TOMATOES

5 lbs. whole small green tomatoes, or larger tomatoes sliced ¼ inch thick
6 c. white sugar
2 c. vinegar
1 T. stick cinnamon
1 t. whole cloves
1 t. whole allspice
1 T. white mustard seed

Wash tomatoes but do not peel. If small tomatoes are used, prick them slightly. Combine sugar, vinegar, and spices; bring mixture to the boiling point and pour it over the tomatoes. Let stand for six hours, or overnight. Drain off liquid and cook it until it coats a spoon. Add tomatoes and cook until clear. Seal in clean hot jars.

Green plums, pears, or peach tomatoes are good for this pickle; large green tomatoes may be sliced and used.

RELISH (UNCOOKED)

3 c. ground cabbage
¾ c. ground onions
1 c. ground pickles
1 pimento
1 c. sugar

Add weakened vinegar to moisten and salt to taste.

CHILI SAUCE (YIELD ABOUT 3 PINTS)

12 large ripe tomatoes
3 sweet peppers
3 small onions
2 t. cloves
2 c. cider vinegar
6 T. sugar
1 T. salt (scant)
2 t. cinnamon bark
2 t. allspice

Scald, peel, and cut up tomatoes. Wash and cut up peppers and onions and add to tomatoes. Boil vinegar with spice bag. Combine all ingredients. Reduce one-third or cook until mixture thickens.

TOMATO CATSUP

1 peck tomatoes	1 T. (scant) allspice
6 onions	1 T. cloves, whole
4 mangoes	2 t. celery seed
1 pt. vinegar	2 t. pepper
1 c. brown sugar	1 t. paprika
¼ box cinnamon bark	2 t. salt

Scald, peel, and cut tomatoes. Chop onions and mangoes and add to tomatoes. Put spices in a bag. Combine all ingredients and cook until reduced one-half. Strain, reheat, and seal in sterilized bottles or jars.

SAUER KRAUT

Trim the cabbage carefully to remove coarse outside and discolored portions. Cut fine, using a cabbage slicer, cutting all but the hard center.

Pack with about 3 per cent salt, approximately 5 oz. salt to 10 lbs. cabbage, into a sterilized barrel or stone crock. Sprinkle a little of the salt over the bottom of the container and then put in three or four inches of the finely sliced cabbage. Pack with a "tamper" of some kind so that the juice comes from the cabbage and it is packed very tightly. Continue packing, alternating salt and cabbage until both are used up. Be sure to reserve some salt for the top of the last layer.

Place a cheesecloth cover over the mixture and a wooden cover about one inch less in diameter than the inside of the container and weight down with a stone or other non-metallic weight. Keep in a room at 86° F. for about 10 days. As scum forms, skim it off, as it may affect the cabbage. When fermentation is complete as indicated by the settling back of the liquid, the kraut may be taken as needed from the container or it may be all removed at once (especially good if previous attempts at holding kraut in the original container have failed) and canned by packing it into jars, partly sealing and processing in hot water bath (pints 25 minutes, quarts 30 minutes).